

REMARKS

In response to the Office Action mailed November 12, 2004, Applicants respectfully request reconsideration. To further the prosecution of this application, the rejections have been carefully considered and are addressed fully herein. The application as presented is believed to be in allowable condition.

Claims 1-22 were previously pending in this application. No claims have been amended, added or cancelled. As a result, claims 1-22 remain pending for examination, with claims 1, 8 and 15 being independent. No new matter has been added.

1. Rejections Under 35 U.S.C. §103

Each of the independent claims has been rejected under 35 U.S.C. §103(a) as purportedly being obvious over U.S. Patent No. 6,108,684 to DeKoning et al. ("DeKoning") in view of U.S. Patent No. 5,867,736 to Jantz ("Jantz"). This rejection is respectfully traversed.

a. Overview of the Cited References

1. DeKoning

DeKoning is directed to a method for load balancing I/O requests among a plurality of controllers in a storage system which employs RAID storage techniques (col. 1, lines 25-28). DeKoning discloses a host computer that communicates I/O requests to the storage system via a bus (col. 8, lines 5 and 40-42). The I/O requests then are processed internally within the storage system according to load balancing techniques which are completely transparent to the host (col. 8, lines 7-8). Specifically, DeKoning discloses "back-end" and "front-end" load balancing techniques (Abstract).

In the back-end technique, an I/O request sent by the host is received by a first controller in the storage system, and the first controller passes the request to a second controller for completion of the request (col. 2, lines 62-65). Data associated with the request is then sent by the second controller back to the first controller, which communicates it to the host (col. 2, lines 65-67). Thus, the involvement of the second controller is transparent to the host in the back-end technique.

In the front-end technique, an I/O request sent by the host is received by a first controller and also is passed to the second controller for processing. However, instead of communicating

data associated with the request back to the first controller for communicating to the host, the second controller communicates it directly to the host (col. 3, lines 18-29). The second controller provides false identification information to the host so that the host “believes” that it is interacting with the first controller (col. 3, lines 34-37). As a result, the involvement of the second controller is transparent to the host in the front-end technique as well.

2. Jantz

Jantz is directed to a method for improving the portability of host-based RAID management systems (Abstract). Specifically, Jantz discloses that RAID management systems may employ “out of band” commands provided by the host operating system to perform “I/O control” (IOCTL) functions to configure and administer a storage system (col. 2, lines 30-33). In particular, the RAID management system may perform I/O control function calls to the host operating system, as distinguished from standard read/write interface function calls (col. 6, lines 31-35). Because I/O control function calls are not standardized across operating systems, certain features may not be available to RAID management systems running on certain host operating systems (col. 2, lines 39-42).

Jantz discloses a utility for processing I/O control-related commands whereby the commands are communicated to a “control port LUN” on the storage system using standard read/write interface function calls (col. 3, lines 20-26). The control port LUN has no associated underlying physical storage, and is provided solely to receive these commands from the RAID management system (col. 7, lines 38-40). The host communicates the I/O control-related commands to the storage device by issuing a write command to the control port LUN, and the write command includes the I/O control-related commands embedded in its data portion (col. 9, lines 37-41).

b. The Combination Is Improper Because The Alleged Motivation For The Combination Is Unsupported

The Office Action alleges that DeKoning discloses the claimed invention except for an out of band control command which bypasses at least one layer in a normal read/write path in the host and which identifies, from among multiple physical paths, a target physical path for its transmission to a device. The Office Action contends that Jantz discloses a method whereby out

of band IOCTL commands may be made to “act more like in-band commands to achieve portability.” The Office Action further alleges that one skilled in the art would have been motivated to process the out of band control commands disclosed by Jantz according to the technique disclosed by DeKoning to “improve RAID management in issues such as reliability”.

The alleged motivation is unsupported by the prior art of record. Neither of the cited references discloses or suggests anything at all related to improving RAID management or reliability. To support this alleged motivation, the Office Action cites two passages in Jantz. The first (at col. 1, line 11) merely states that Jantz relates generally to storage systems that employ RAID storage techniques. The second (at col. 1, lines 52-57) states that RAID techniques are designed to improve reliability in storage systems. Neither DeKoning nor Jantz disclose any modification to the underlying RAID storage techniques for improving reliability, or any other purpose.

In view of the foregoing, it is respectfully asserted that the motivation alleged in the Office Action is unsupported by the prior art of record. Thus, the combination of DeKoning and Jantz is improper, such that the rejection of claims 1-22 under 35 U.S.C. §103(a) over this combination should be withdrawn.

c. The Claims Distinguish Over Any Combination of DeKoning and Jantz

Even if the asserted combination were proper (and Applicants believe that it is not), Applicants respectfully assert that the claims patentably distinguish over any combination of DeKoning and Jantz, neither of which is relevant to the subject matter recited in Applicants’ claims. Neither of the references discloses or suggests a multi-path system wherein a host computer is coupled to a storage system via multiple physical paths. Rather, DeKoning discloses a system wherein a host computer issues an I/O request to a storage system via a bus, which is the sole physical path provided for communication between the host computer and the storage system.

As discussed in Applicants’ previous response filed July 9, 2004 (which is incorporated herein by reference), FIG. 12 of Applicants’ specification depicts an exemplary multi-path system. FIG. 12 depicts physical paths P1-P4 between host computer 101 and storage system 103. As described in Applicants’ specification, some multi-path systems may employ load

balancing techniques to select a particular physical path for communicating an I/O request between the host and storage device (p.30, lines 29-31). In contrast, DeKoning does not disclose selecting a physical path for communicating an I/O request between a host and storage device, and cannot, given that there is only one physical path available in DeKoning – bus 252. Instead, DeKoning involves load balancing across a plurality of controllers within a storage system, not across communication paths between a host and a storage system. In this respect, any “paths” which may be selected in DeKoning are internal to the storage system 100, and are transparent to the host. Said differently, from the perspective of the host, it submits an I/O request to the storage system by providing the I/O request on to the bus with the address of the storage system specified as the destination address, and is completely unaware of how the storage system will process the I/O request using any internal “paths” it may have.

Because the asserted combination does not disclose a multi-path system, it necessarily does not disclose or suggest an out of band control command which identifies, from among multiple physical paths, a target physical path for its transmission to a device. The Office Action asserts that the IOCTL commands disclosed by Jantz meet the limitation of an out of band control command. However, Jantz does not anywhere disclose or suggest that an IOCTL command identifies a target physical path from among multiple physical paths for its transmission, and DeKoning does not cure this deficiency. Not only does DeKoning fail to disclose multiple physical paths from which a target physical path may be specified, but the load balancing technique disclosed by DeKoning is performed in a manner which is completely transparent to the host. That is, DeKoning discloses that a plurality of controllers on the storage system select the appropriate way to satisfy an I/O request issued by the host, in a manner that the host cannot influence or control. In fact, the host is not even aware of the existence of multiple controllers. Neither DeKoning nor Jantz relates to a method of processing a host command which identifies a target physical path for its transmission from among multiple physical paths to a device.

Thus, Applicants respectfully assert that the asserted combination is simply not relevant to the subject matter recited in the claims, as pointed out more particularly below.

1. Claims 1-7

As should be appreciated from the foregoing, the prior art of record does not teach or suggest a method of processing an out of band command executed by a host computer in a multi-path system, wherein the out of band control command identifies a target physical path for its transmission from among multiple physical paths. Therefore, the prior art of record necessarily fails to teach or suggest a method of selecting a physical path for transmitting such an out of band control command based upon a selection criteria that enables the selected physical path to be other than the target physical path identified by the out of band control command.

The rejection appears to take the position that the load balancing among the controllers 102, 104 in DeKoning creates different paths within the storage system 100 to a device 110. However, no command in DeKoning specifies any such “path” within the storage system 100, such that the combined system does not teach selecting a physical path for transmitting an out of band control command between a host computer and a device from among multiple physical paths, based upon a selection criteria that enables the selected physical path to be other than the target physical path identified by the out of band control command.

In view of the foregoing, it is respectfully asserted that claims 1-7 patentably distinguish over the prior art of record, such that the rejection of these claims under 35 U.S.C. §103 should be withdrawn.

2. Claims 8-14

Claim 8 recites a computer readable medium encoded with a program that, when executed, performs a method substantially similar to claim 1. Thus, for the reasons discussed above, it is respectfully asserted that claims 8-14 patentably distinguish over the prior art of record, such that the rejection of these claims under 35 U.S.C. §103 should be withdrawn.

3. Claims 15-22

Claim 15 is directed to a host computer for use in a multi-path system that comprises at least one processor to execute an out of band control command that identifies a target physical path for its transmission from among multiple physical paths, as well as at least one controller that selects a physical path for transmission of the out of band command based upon a selection

criteria that enables the selected physical path to be other than the target physical path identified by the out of band control command.

As should be appreciated from the foregoing, the prior art of record fails to teach or suggest a host computer for use in a multi-path system, or the processing of an out of band control command that identifies a target physical path for its transmission. In addition, the prior art of record fails to teach a host computer including at least one controller that can select a physical path for transmitting such a command based upon a selection criteria that enables the selected path to be other than the physical path specified by the command. Furthermore, the load balancing disclosed by DeKoning that the Office Action relies upon for selecting a physical path is performed within the storage system 100. DeKoning does not disclose a host computer including at least one controller that selects a path for transmission of an out of band control command.

In view of the foregoing, it is respectfully asserted that claims 15-22 patentably distinguish over the prior art of record, such that the rejections of these claims under 35 U.S.C. §103 should be withdrawn.

CONCLUSION

A Notice of Allowance is respectfully requested. The Examiner is requested to call the undersigned at the telephone number listed below if this communication does not place the case in condition for allowance.

If this response is not considered timely filed and if a request for an extension of time is otherwise absent, Applicant hereby requests any necessary extension of time. If there is a fee occasioned by this response, including an extension fee, that is not covered by an enclosed check, please charge any deficiency to Deposit Account No. 23/2825.

Respectfully submitted,
Fred Oliveira et al., Applicants

By:



Richard F. Giunta, Reg. No. 36,149
Wolf, Greenfield & Sacks, P.C.
600 Atlantic Avenue
Boston, Massachusetts 02210-2206
Telephone: (617) 646-8000

Docket No.: E0295.70136US00

Date: February 11, 2005

x02/12/05x